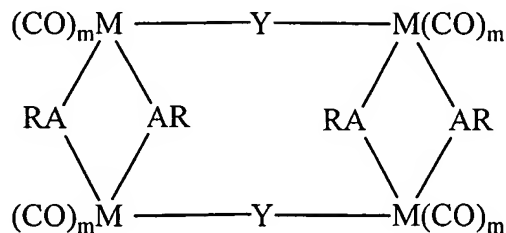


WHAT IS CLAIMED IS:

1. A rectangular supramolecule having the following structure:



wherein

M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os;

Y is a nitrogen-based didentate ligand;

A is O, S, Se, or Te;

R is C₃~C₁₆ alkyl, (CH₂)_n-aryl, or (CH₂)_n-aryl-(O-C₁~C₁₆ alkyl)_p, in which n is 0-15, p is 1-3; and

m is 1, 2, 3, 4, or 5.

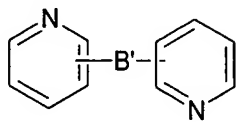
2. The rectangular supramolecule of claim 1, wherein M is Re.

3. The rectangular supramolecule of claim 2, wherein m is 3.

4. The rectangular supramolecule of claim 1, wherein R is C₃~C₁₆ straight chain alkyl.

5. The rectangular supramolecule of claim 1, wherein A is O.

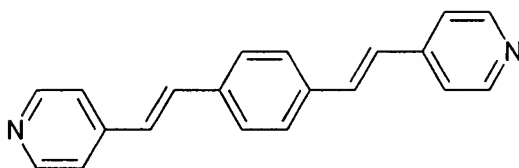
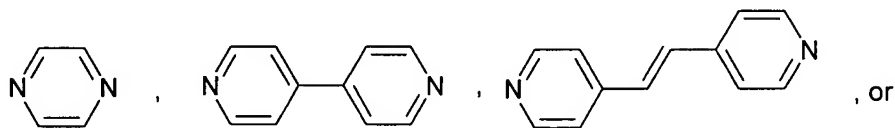
6. The rectangular supramolecule of claim 1, wherein Y is diazine or a ligand of the formula:



wherein B' is a bond, alkyl, alkenyl, alknyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

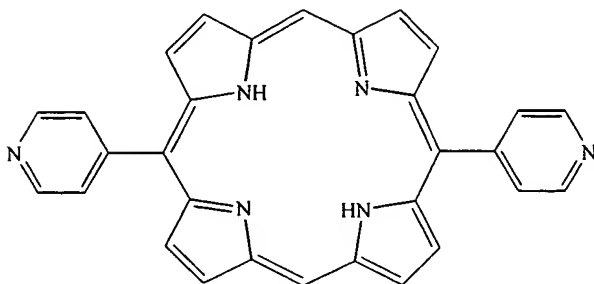
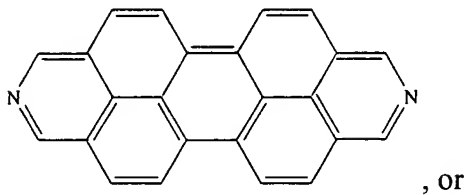
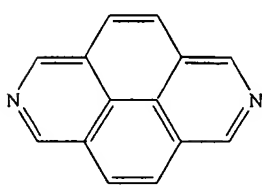
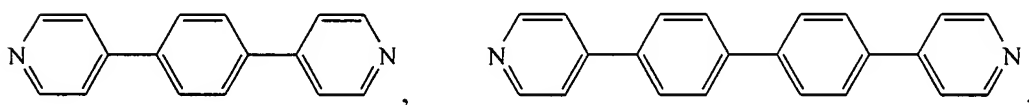
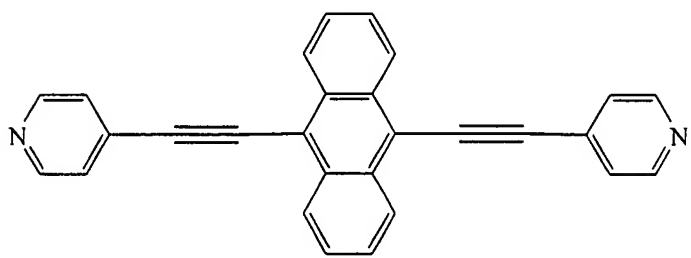
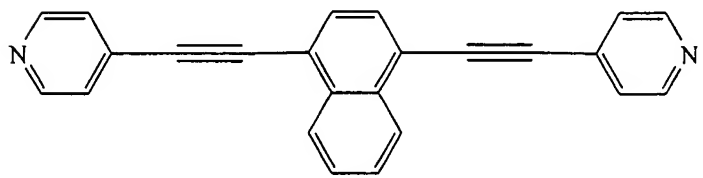
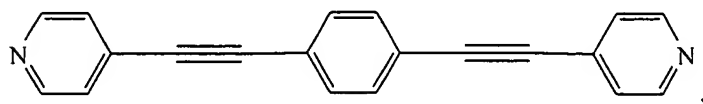
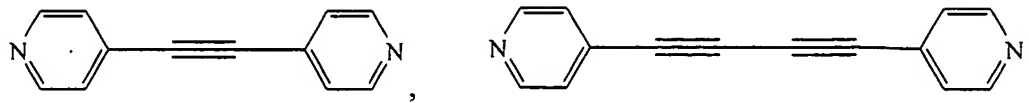
7. The rectangular supramolecule of claim 6, B' is a bond, alkenyl, alknyl, or aryl.

8. The rectangular supramolecule of claim 6, wherein Y is

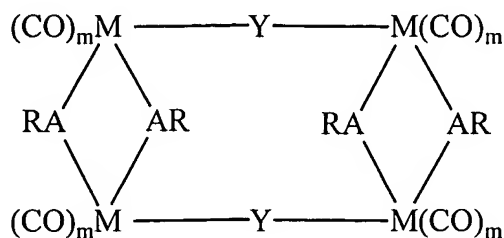


9. The rectangular supramolecule of claim 6, wherein M is Re, and m is 3.
10. The rectangular supramolecule of claim 6, wherein R is C₃~C₁₆ straight chain alkyl.
11. The rectangular supramolecule of claim 6, wherein A is O.

12. The rectangular supramolecule of claim 6, wherein Y is



13. A method for making a rectangular supramolecule having the following structure:

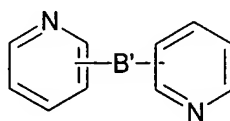


- wherein M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os; Y is a nitrogen-based didentate ligand; A is O, S, Se, or Te; R is C₁~C₁₆ alkyl, (CH₂)_n-aryl, or (CH₂)_n-aryl-(O-C₁~C₁₆ alkyl)_p, in which n is 0-15, p is 1-3; and m is 1, 2, 3, 4, or 5;

the method comprising:

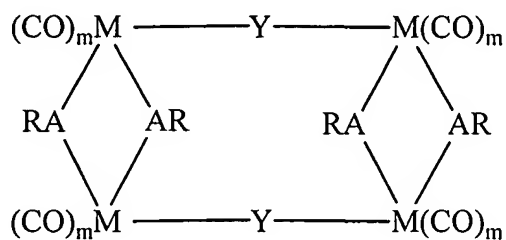
reacting M(CO)_{m+2} with a nitrogen-based didentate ligand in the presence of an RAH at an elevated temperature to form the rectangular supramolecule.

14. The method of claim 13, wherein M is Re and m is 3.
15. The method of claim 13, wherein RAH is a C₁~C₁₆ aliphatic alcohol.
16. The method of claim 13, wherein Y is diazine or a ligand of the formula:



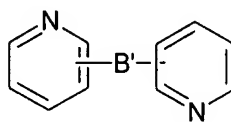
wherein B' is a bond, alkyl, alkenyl, alkynyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

17. A composition for emitting luminescence at room temperature, comprising:
a rectangular supramolecule having the following structure:



- wherein M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os; Y is a nitrogen-based didentate
5 ligand; A is O, S, Se, or Te; R is $\text{C}_1\text{--}\text{C}_{16}$ alkyl, $(\text{CH}_2)_n\text{-aryl}$, or $(\text{CH}_2)_n\text{-aryl-(O-C}_1\text{--}\text{C}_{16}\text{ alkyl)}_p$,
in which n is 0-15, p is 1-3; and m is 1, 2, 3, 4, or 5; and
an aqueous solution.

18. The composition of claim 17, wherein M is Re and m is 3.
19. The composition of claim 17, wherein R is $\text{C}_1\text{--}\text{C}_{16}$ straight chain alkyl.
20. The composition of claim 17, wherein A is O.
21. The composition of claim 17, wherein Y is diazine or a ligand of the formula:



wherein B' is a bond, alkyl, alkenyl, alknyl, cyclyl, heterocyclyl, aryl, or heteroaryl.